Part IV: Groundwater Assessment

1. Groundwater Quality

The Department in cooperation with the USGS has established a new shallow ground water monitoring network designed to monitor water at or near the water-table. Such ground water is often the most immediately vulnerable portion of the entire ground water system to pollution. This network was discussed in the 1998 305(b) Report to which the reader is referred for details.

Ground water quality data and a brief discussion of recent finding based upon data collected in this new network will be presented in the USGS Water Year Report for 1999 (USGS, 1999. Data presented will be based upon results obtained from 30 shallow wells sampled in 1999; 28 of which are located in the Lower Delaware Region of the state and randomly distributed throughout WMAs #17, 18, 19 and 20. The 2 remaining wells are located in the Atlantic Coastal Region, one well in WMA #15 and one in #16.

2. Sources of Groundwater Contamination

2.1 Classification Exception Area (CEA) Delineations

For the past 25 years NJDEP's Site Remediation Program (SRP) has been identifying the presence of ground-water pollution at contaminated sites. In the past 5 years, where appropriate, the areal extent and depth of the contamination has been defined and a Classification Exception Area (CEA) has been established. A CEA is defined as that portion of a Classified groundwater use area where the "groundwater use" is restricted based on the class of the ground water in the surrounding aquifer.

New Jersey classifies ground water based on quality and/or aquifer properties (N.J.A.C. 7:9-6.5). There are three ground-water classes: GW I, GW II and GW III.

Class GW I is ground water that maintains areas of special ecological resources. These are defined as the watershed of streams classified as FW1, ground water under Natural Areas as designated by the Department pursuant to N.J.A.C. 7:2-11 and ground water in the Cohansey and Kirkwood aquifers under the New Jersey Pinelands.

Class GW II ground waters have a designated use potable ground waters with conventional water supply treatment. Class GW II-A refers to water that is now potable. Class GW II-B refers to water that could meet potable standards with conventional treatment. In general, all ground water in New Jersey outside of defined GW I areas is assumed to be of GW II-A status unless shown otherwise by site-specific sampling

Class GW-III ground waters are not suitable for potable water use due to natural hydrogeologic characteristics or natural water quality. Class GW III-A indicates an aquitard that cannot supply economically significant volumes of water and is outside of all GW I areas. Class GW III-B ground water consists of all geologic formations or units which contain ground water having natural concentrations or regional concentrations (through the action of salt-water intrusion) exceeding

3,000 mg/l chloride or 5,000 mg/l total dissolved solids, or where the natural quality of ground water is otherwise not suitable for conversion to potable uses.

To date, about 1,400 CEA's have been approved with about 300 new ones being identified each year. About 90% of these have been mapped in the NJDEP Geographic Information System (GIS). The NJDEP is developing a strategy for using this information in the well permitting process and the Source Water Protection Program. Public access is planned for this information through interactive mapping applications on the INTERNET. CEA's tend to be very small spatially and do not, as a group, cover an appreciable percentage of the State.

There are over 6,000 contaminated sites in New Jersey that have confirmed groundwater contamination with listed hazardous substances. In the future many more sites will receive a CEA designation and be mapped into the GIS. In the interim, detailed groundwater and soil contamination information is being collected digitally for all known contaminated sites in NJ, and a key element of these data sets include the well or soil sampling locations.

Detailed guidance on how New Jersey defines CEAs in on the internet at:
http://www.state.nj.us/dep/srp/dl/ceaguid2.doc

2.2 Ground Water Impact Areas

For the past 20 years NJDEP has been identifying large areas (regional) of groundwater contamination. These groundwater impact areas (GWIAs) are defined as an area where five or more domestic wells in a small area have water exceeding drinking water standards. Usually these cannot be linked to a specific source or responsible party. Typically the determination of areal extent and depth of ground-water contamination has been less rigorous than that delineated in a site investigation but is usually based on the results of home potable well sampling and is mapped based on the lot and blocks of properties affected. At the present time SRP is engaged in an effort to reevaluate the groundwater quality conditions in these areas, and it will be several years before the activity is complete. As with CEAs, GWIAs have been mapped into the NJDEP's Geographic Information System (GIS) computer network.

More information on GWIAs is on the internet at
http://www.state.nj.us/dep/srp/publications/site_status/1999/html/99intro15.htm

2.3 Well Restriction Areas (WRAs)

The following is from the CEA guidance document cited above in 2.1.

> "Pursuant to N.J.A.C. 7:9-6.6(d), the Department is obligated to restrict or require the restriction of potable ground water uses within any CEA where there is or will be an exceedence of the Primary Drinking Water Standards (N.J.A.C. 7:10). Therefore, when contaminant concentrations in a CEA exceed Maximum Contaminant Levels (MCLs), and designated aquifer use based on classification includes potable use, the Department will identify the CEA as a Well Restriction Area (WRA). The WRA functions as the institutional control by which potable use restriction can be effected.

> "The Department ordinarily will not prohibit installation of wells in WRAs but will identify any special installation and construction requirements (for example, installation of double-cased wells below the first confining layer) through the well permit program administered by the Bureau of Water Allocation. Prohibition of well installation may be warranted if installation and pumping of a proposed well would negatively impact an approved remediation. For example, well installation may be prohibited if use of a proposed industrial supply well would draw a portion of a contaminant plume into its cone of influence and alter the configuration of the plume, potentially contaminating a previously clean portion of the aquifer. Although WRAs will be the mechanism by which the Department primarily will protect potable users, restrictions on installation and use of other types of wells (e.g., irrigation, industrial, recovery) also can be required."

There are 98 identified well restriction areas in New Jersey. These cover less than 5% of the state. All have been mapped into the NJDEP's Geographic Information System (GIS) computer network.

2.4 CEA, GWIA and WRA relationship

The relationship between CEAs, GWIAs and WRAs is not straightforward. In general, all CEAs are also WRAs. CEAs are identified with a suspected (or proven) responsible party. The converse is not true; there are WRAs which are not part of a CEA. GWIA's tend to be larger with perhaps multiple potential responsible parties, or perhaps no identified polluter. A GWIA may include one or more CEAs or WRAs, or it may not.

2.5 Pilot Study: GIS-Based Trackdown of Pollution Sources from Known Contaminated Sites to the New York–New Jersey Harbor Estuary

To investigate the potential for uncontrolled/unmeasured toxic substance discharges from contaminated sites to groundwater and subsequently to surface waters, NJDEP's Division of Science Research and Technology (DSRT) and SRP have been awarded a Performance Partnership Grant from EPA Region 2 to perform a Pilot Study towards developing a Geographic Information System (GIS) -based, source trackdown tool. The tool will be used to identify and prioritize pollution sources from known contaminated sites and to assess the potential for contaminant movement into the waters, sediments and biota of the New York–New Jersey Harbor, hence the Pilot Study is being performed under the auspices of the Harbor Estuary Program (HEP).

NJDEP's 1996 Known Contaminated Sites list (KCSL) contains approximately 9,000 sites statewide, of which 1,400 potential sites and landfills were identified as meeting the criteria for inclusion (i.e., in proximity to water and a potential contaminant source). Since 1997 the technical rules for site remediation require that all hazardous site investigations in the State (i.e., public and private) must deliver investigative data in a NJDEP defined electronic (digital) format. Preliminary analysis of the data reveals that the majority of this information is spatially accurate and contains a wealth of detail about the spatial distribution and concentration of different contaminants in groundwater and soils.

Inclusion of digital data will provide a new, more accessible dimension to identifying contaminated sites posing the greatest threat to the Estuary. In the Pilot, digital data will be analyzed and manipulated through EQuIS, the SRP's data management system. EQUIS is designed to enable the importation of site data to the NJDEP's GIS for visualization, distribution and further analysis. Data will be summarized and displayed cartographically using a GIS technology and digital environmental data collected as part of NJDEP's Site Remediation Programs (SRP) remedial investigation and clean up process (pursuant to NJAC 7:26E).

2.6 Arsenic in Ground Water of New Jersey

The current federal maximum contaminant level (MCL) for arsenic in drinking waters is 50 micrograms per liter (ug/l), or parts per billion (ppb). During USEPA's extended review, the Commissioner of NJDEP has recommended that New Jersey propose and adopt a state MCL of 10 ppb for arsenic in finished drinking water.

In 1999, a review of arsenic in ground-water data for New Jersey had been conducted. Data from the Ambient Ground Water Quality Network in the Valley and Ridge, Highlands and Piedmont Physiographic Provinces (see Fig IV-2.4-1) (Serfes, 1994; Serfes, in press), coupled with data in the Coastal Plain (Kozinski et al, 1995; Fusillo et al, 1984) revealed that ground water in the Piedmont generally has higher arsenic concentrations than in the other physiographic provinces in New Jersey. This finding was also supported by Public Water Supply data provided by the Department's Bureau of Safe Drinking Water. The data showed that 6 percent of the wells sampled in the Piedmont had arsenic concentrations greater than 10 ppb while only 0.5 percent in the Coastal Plain exceeded 10 ppb. No wells sampled in the other 2 provinces exceeded 10 ppb. A study is being conducted by the Department's Geological Survey to determine the sources, mobilization, transport and fate of the arsenic in the western Piedmont where the highest concentrations are found.

Results from reconnaissance sampling in the western Piedmont indicate that up to 15 percent of the 92 wells sampled have concentrations exceeding the NJDEP recommended MCL of 10 ppb. The highest concentrations are found in the Passaic, part of the Jurassic-Triassic Brunswick formation illustrated in Figure IV-2.4-2, and in the Triassic Lockatong Formations (Fig IV-2.4-2). The lowest levels are in the Triassic Stockton Formation and Jurassic Diabase. Based on the chemistry of several rock samples and the location of the highest arsenic concentrations, it is believed that the arsenic is mainly natural in origin and associated with dark fine grained lucustrine sedimentary rocks of the Passaic and Lockatong Formations. Further work is being conducted which may lead to drilling and corrective practices that could reduce exposure to arsenic.

A homeowner's guide to arsenic in private well water has been developed by the NJDEP and is available from the Department's Bureau of Safe Drinking Water by calling (609) 292-5550 or via the NJDEP's website at: *http://www.state.nj.us/dep/dsr/arsenic/guide.htm.*

2.7 Mercury in Ground Water of New Jersey

The drinking water standard for mercury is 2 ppb. Since 1982 the NJDEP has been investigating exceedences of mercury in the ground water of southern New Jersey. Greater concentrations have been observed in hundreds of private wells tapping the Kirkwood-Cohansey aquifer.

However, there were thousands of wells with no mercury contamination and the pattern of contamination did not immediately point to an obvious source. In February 1992, the NJDEP and USGS issued a press release recommending all owners of a domestic well pulling water from the Kirkwood-Cohansey aquifer to test their water for mercury.

The New Jersey Geological Survey determined that this mercury was unlikely to be naturally occurring (Dooley, 1992). A thorough study by the US Geological Survey (USGS) (Barringer and others, 1997) also concludes that the mercury in these wells is unlikely to be: naturally occurring in the aquifer; introduced by fixtures in the households; ascribable to nearby landfill and/or pollution sites; or the result of sampling and/or laboratory error. Additionally, atmospheric deposition appears to be a minimal source of mercury in the ground water. The most likely sources of mercury in the shallow ground waters of southern New Jersey are historical land application of pesticides containing mercury. In 1998 the NJDEP requested the USGS start a more detailed study of land use impacts on mercury in ground water and the impacts of mercury-contaminated ground water on surface water

In 1998, NJDEP Commissioner Robert C. Shinn signed an administrative order which created the New Jersey Mercury Task Force. Its charge is to review current science on the impacts of mercury pollution; determine impacts on New Jersey's ecosystems and on human health; inventory and assess current sources; review current policies for mercury management; and develop a mercury reduction plan for New Jersey. More information on the Mercury Task Force is available on the NJDEP Division of Science, Research and Technology website at:
http://www.state.nj.us/dep/dsr/mercury_task_force.htm

2.8 Domestic Well Quality

In New Jersey Ocean County has had a program in effect since 1987 that requires the sampling of domestic well quality whenever a home is sold or a lease for more than 6 months is signed. These data have remained in Ocean County and have not been used by the NJDEP for any systematic investigation of ground-water quality. This is partially due to non-reporting of the aquifer which supplies water to the tested well. In 2000 there were about 70,000 entries in this system.

In March 2001 the New Jersey legislature passed the "Private Well Testing Act" which mandates testing of water quality every time a house with a domestic well is sold. Homes which are leased must also be tested within 18 months of this bill becoming effective then at least once every 5 years thereafter. This bill was signed into law on March 23, 2001.

The parameters to be tested for are bacteria (total coliform), nitrates, iron, manganese. pH, volatile organic compounds with MCLs, lead, and radium (using the 48-hour gross alpha test). The NJDEP may add additional items to this list in areas where concerns exist. Possible additions include arsenic and mercury. The NJDEP may also designate certain areas where some parameters do not need to be tested for. All testing is to be done by certified labs. A copy of each analysis must be submitted to the NJDEP to help ground-water studies. The legislature appropriated $1 million for the NJDEP and local health departments to implement this act.